

***Spirogyra cardinia* (Zygnemataceae, Zygnematophyceae, Chlorophyta): a new species of freshwater alga from Victoria, Australia.**

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Abstract

Spirogyra cardinia (Zygnemataceae, Chlorophyta), a new species of freshwater alga from Victoria, Australia, in Section *Conjugata* (Vaucher) Hansg., *Punctata*-Group (Kadłubowska 1984) from the Cardinia Reservoir area in south-eastern Victoria, is described and illustrated. It is morphologically similar to *S. bellis* (Hassall) Cleve (which is in the *Maxima*-Group (Kadłubowska 1984)) and *S. occidentalis* (Transeau) Czurda (which is in the *Punctata*-Group (Kadłubowska 1984)) but differs in chloroplast number and vegetative filament and zygospore dimensions.

Introduction

Our recent census from literature records (Lewis & Entwisle 1998) accepted 31 species of *Spirogyra* Link from Australia, while Kadłubowska (1984), in the latest worldwide monograph of the genus, recognized 386 species in total. Since Kadłubowska's monograph, more than 30 new species have been described from around the world, yet none were from Australia. This paper describes a new species discovered as part of Australia-wide collecting for the preparation of an account of Zygnemataceae for the *Algae of Australia* project.

Methods

Preparation of Material

Specimens were preserved initially in 5% commercial formalin. After preparing dried specimens and permanent microscope mounts, the remaining material was transferred to 70% ethanol with 5% glycerol. For the microscope slides, specimens were stained with 1% aniline blue and placed in 10% *Karo* corn syrup with 0.25% phenol then mounted in 40% *Karo* corn syrup with 0.25% phenol.

Taxonomy

Spirogyra cardinia S.H. Lewis, sp. nov.

Cellulae vegetativae 42–156 μm longae, 66–75 μm latae, parietes extremi plani; chloroplasti 1(–2) anfracti 2–6–plo in cellulis; pyrenoides 5–15, 6 μm latae. Conjugatio scalariformis, canalibus ab utrinque cellulis formatis, extremitatibus tumidis. Gametangia (et cellulae steriles aliquot) in latera conjugationis inflata (75–90 μm latae) abbreviata plerumque. Zygosporae ellipsoidea uniformes, 63–76 μm longae, 36–48 μm latae, exospora laeve incolorata, mesospora puncticulosa (punctula ad 1.5 μm lata), aurea.

Type: Australia, Victoria, Narre Warren East, small pool near Kangaroo Flat Picnic Area, in Cardinia Reservoir Park, *S.H. Lewis 403*, 20.v.1998 (holotype MEL 2046440; isotype NSW).

Vegetative cells 42–156 μm long, 66–75 μm in diameter, length to diameter ratio = 1.15, with plane end walls; chloroplasts 1(–2), making 2–6 turns; pyrenoids 5–15, up to 6 μm in diameter. Conjugation scalariform, conjugation tubes formed equally by both gametan-

gia and swollen where they meet; gametangia (and some sterile cells) inflated on the conjugation side to 75–90 µm and often shorter than the vegetative cells. *Zygosporos* ellipsoid, uniform, 63–76 µm long, 36–48 µm in diameter, length to diameter ratio = 1.78, exospore smooth and colourless, mesospore finely punctate and golden brown to yellow, pits to 1.5 µm in diameter.

Diagnostic Features: *Spirogyra cardinia* belongs in the section *Conjugata* on the basis of its plane walls, and in the *Punctata*-Group on account of the mostly single chloroplast per cell and ornamented mesospore (Kadłubowska 1984). It differs from all other species in this group by having broader filaments (see Table 1 and Fig 1). In this group, *S. cardinia* is most similar to *S. occidentalis* (Transeau) Czurda in zygospore size (50–105 µm long, 36–61 µm in diameter in that species). However, *S. occidentalis* has much narrower vegetative cells (40–54 µm in diameter, although Czurda (1932 p.183, quoted in Kadłubowska 1984, p. 342) describes 'swollen barrel-shaped' cells) and gametangia that are cylindrical or only inflated up to 66 µm. The orientation of the zygospores in *S. occidentalis* is parallel to the main axis, while that of *S. cardinia* is at 45–90 degrees, with only some parallel. From the illustrations of *S. occidentalis*, the new species also appears to have considerably shorter fertile and sterile cells.

Spirogyra cardinia is also comparable to *S. bellis* (Hassall) Cleve, from the *Maxima*-Group, a group comprising species with two or more chloroplasts and sculptured zygospore walls. The new species occasionally has cells with two chloroplasts, and *S. bellis* has similar vegetative filament dimensions. *Spirogyra bellis*, however, has 5–7 chloroplasts per cell and they are more spiralled (2–6 turns per cell cf. 1). It also has larger zygospores (64–105 µm long, 45–70 µm in diameter; Kadłubowska 1984) that are globose or lenticular rather than ellipsoid, the conjugation tubes are not swollen at the ends, and the gametangia are usually swollen on both sides or enlarged. No other species in the *Maxima*-Group are likely to be confused with *S. cardinia*.

Spirogyra rugulosa Iwanoff, in the *Punctata*-Group, is superficially very similar to the new species but the conjugation tubes are clearly formed by the male gametangia and the zygospores are broader. A recent collection (*S.H.Lewis* 718 (MEL)) from the type locality of *Spirogyra cardinia* has been referred to *S. rugulosa*. In this collection the wall was not as obviously punctate as that of the new species, although the vegetative filaments were similarly large. The conjugation tubes were, however, all definitely formed

Table 1. Comparison of *Spirogyra cardinia* with similar taxa and groups mentioned in the text. Data from Kadłubowska 1984 and current study.

Taxon	Veg. cells diam. µm	Zygosporos diam. µm	Zygosporos length µm	Chloroplast No.	Tubes formed by
<i>S. cardinia</i>	66–75	35–48	63–76	1(–2)	both gametangia
<i>Punctata</i> -Group	11–62	19–68	26–150	1(–3)	varies
<i>S. rugulosa</i> Iwanoff (Kadłubowska 1984)	45–62	45–55	27–90	1	male gametangia
<i>S. rugulosa</i> (S.H.Lewis 718)	63–78	42–48	66–78	1	male gametangia
<i>S. occidentalis</i> (Transeau) Czurda	40–54	36–61	50–105	1–3	both gametangia
<i>S. bellis</i> (Hassall) Cleve	65–80	45–70	64–105	5–6	both gametangia

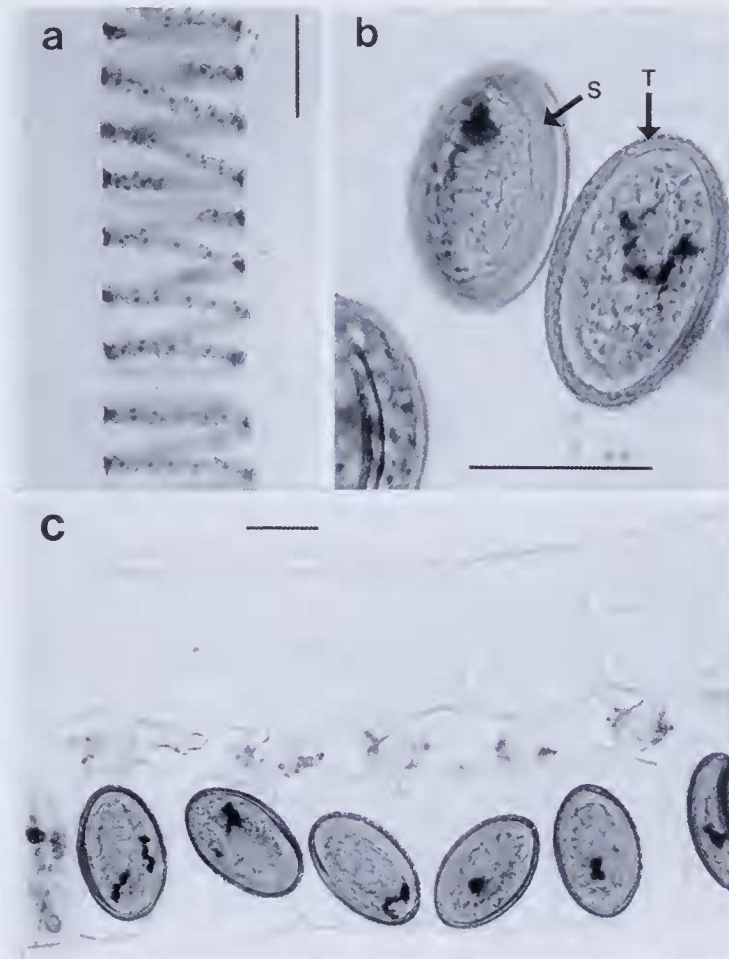


Figure 1 a–c *Spirogyra cardinia* sp. nov.; a. vegetative cells; b. zygospores showing mesospore ornamentation visible in transverse section (T) and surface view through exospore (S); c. conjugating cells. Scale: 40µm.

by the male gametangia and therefore matched those of *S. rugulosa*, whereas the tubes of the new species were all obviously formed by both gametangia. Both of these populations warrant further study.

Distribution and Habitat: *Spirogyra cardinia* is only known from the type collection. The pool was about 30 cm deep and 3 m in diameter and apparently permanent. Other collections from the same site, at the same time and at similar times in the following year, yielded a number of other species of *Spirogyra*, none of which resembled *S. cardinia*. *Spirogyra cardinia* was loosely associated with *Callitriche stagnalis* Scop., *Cyperus eragrostis* Lam. and *C. lucidus* R.Br., and with *Nitella leptostachys* A.Br. var. *leonhardii* (R.D.Wood) R.D.Wood.

Etymology: The epithet refers to the location from which it was collected.

Conservation Status: Using the criteria of Briggs and Leigh (1996) the Risk Code is assessed at 1K. Based on current collecting it is clearly rare, however, as with all the ephemeral Zygnemataceae, it may be widespread. Making decisions regarding the conservation status of algae in Australia is especially difficult due to a lack of distributional data, paucity of fertile (needed for identification) collections, changes to the fragile aquatic environments (Entwistle 1997) and the transient nature of *Spirogyra*.

Discussion

Although this species is differentiated from the other species in the *Punctata*-Group (Kadłubowska 1984) by its vegetative cell dimensions, a character viewed as being influenced by polyploidy (Hoshaw *et al.* 1985, 1987; Hoshaw and McCourt 1988), this difference appears to be of such magnitude that the entity deserves to be recognized taxonomically. Furthermore, it differs from the most similar species, such as *Spirogyra bellis*, *S. rugulosa* and *S. occidentalis*, by a number of characters apparently less influenced by polyploidy, such as spore, gametangia and tube shape, chloroplast number and mesospore ornamentation.

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